Operating Experience Weekly Summary 97-46

November 7 through November 13, 1997

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EVENTS

1. MIS-WIRED WATTMETER CAUSES SHORT CIRCUIT AND EQUIPMENT DAMAGE

On November 4, 1997, at the Savannah River Site, an electrical subcontractor accidentally mis-wired a wattmeter causing a short circuit that destroyed the meter and its enclosure. The electrical subcontractor had completed a modification to a disconnect switch for a soil vapor extraction unit, and two operators and a mechanic were returning the unit to service. When the mechanic closed the disconnect switch, the short circuit occurred. This caused the meter panel to blow out, breaking the glass cover and throwing it approximately 6 to 8 feet. Investigators determined that the electrical subcontractor reversed two wires on the wattmeter and no one verified the re-wiring before re-energizing the circuit. Although neither the mechanic nor the operators were injured, this near-miss occurrence had the potential for serious injury. (ORPS Report SR--WSRC-ERF-1997-0018)

The facility manager conducted a critique of the event. Critique members determined that the electrical subcontractor reversed the wires on the back of the wattmeter causing a phase-to-phase, 480-volt short circuit in the meter. They also determined that the subcontractor cut the original wires to length before connecting them to the meter because they were too long for the modification. However, he failed to mark the wires before cutting off the labeled ends, then forgot how the wires should be attached. The operators and mechanic were fortunate that they stood to the side of the disconnect switch. If they had been in front of the switch, they would have been in the direct path of the meter. Critique members also determined that, although there was a work package with instructions and drawings, the job relied on skill-of-the-craft, which may have been a contributing cause. They determined that both the direct and root causes were personnel error (inattention to detail).

OEAF engineers reviewed another recent event that resulted in equipment damage when a subcontractor reversed electrical wires while performing a modification. On October 14, 1997, at the Savannah River Site, a subcontractor electrician replaced an automatic transfer switch in a cubicle with a manual transfer switch and wired the switch incorrectly by reversing the wires on the load and emergency terminals. Mechanics and operators removed the lockout/tagout for the switch modification and racked-in and closed the normal feeder breaker and the emergency feeder breaker. When the emergency feeder breaker closed, they heard a loud noise and saw smoke coming from the cubicle. No injuries resulted from the event. No one verified that the subcontractor had wired the switch correctly before re-energizing the equipment. This modification also relied on skill-of-the-craft. (ORPS Report SR--WSRC-LTA-1997-0030)

NFS reported numerous events in the Weekly Summary where equipment was mis-wired during modification. Following are some examples.

- Weekly Summary 97-33 reported that an instrument technician at the Oak Ridge National Laboratory received an electrical shock while source-testing a radiation monitoring instrument because of a mis-wired alarm bell. (ORPS Report ORO--ORNL-X10METCER-1997-0008)

- Weekly Summary 96-42 reported that an electrical arc occurred when an electrician placed an inoperable set of electro-hydraulic shears on a metal floor at Fernald. Investigators determined that the extension cord used for the shears had been mis-wired causing the power pack casing to be energized. (ORPS Report OH-FN-FDF-FEMP-1996-0054)

- Weekly Summary 95-25 reported that instrument specialists at Los Alamos National Laboratory determined that a criticality alarm system was mis-wired and would not function as designed in the event of a large criticality accident. (ORPS Report ALO-LA-LANL-TA55-1995-0027)

OEAF engineers searched the ORPS database from 1994 to present for events reported across the DOE complex under the nature of occurrence "near-miss" and found 539 occurrences. Figure 1-1 shows that facility managers reported management problems as the root cause for 40 percent of the occurrences. They also reported that personnel error accounted for 26 percent of the violations. Further review shows that 29 percent of the management problems were reported as inadequate administrative control, and inattention to detail accounted for 46 percent of the personnel errors.

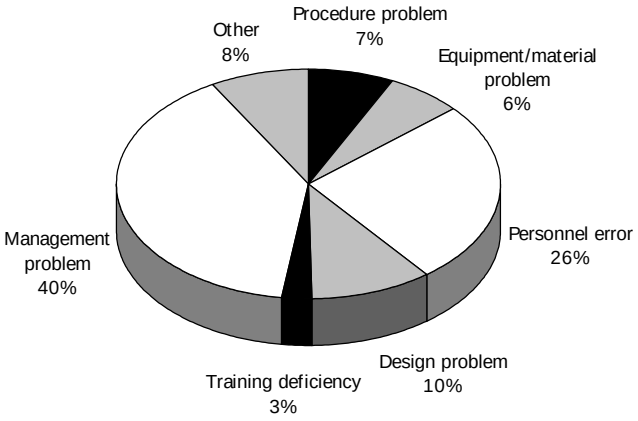


Figure 1-1. Distribution of Root Causes for All Near-Miss Occurrences[1]

This event underscores the importance of attention to detail and the need to verify equipment modifications before placing the equipment in service. Verification of modifications, such as wiring changes, should be performed against approved drawings to help identify mistakes. Lifted and landed leads should be logged and verified. An independent verifier can also be used to identify errors. Independent verification uses a qualified person other than the one performing the task to verify correctness. It is unlikely that two workers will make the same mistake. Proper post-modification testing is important to demonstrate that a modification has been performed correctly and to identify mistakes before damaging equipment or risking personnel injury.

NFS advocates self-checking, a risk management tool designed to reduce the potential for human error. Self-checking requires distinct thoughts and actions that focus attention at a specific moment before performing a task. DOE/EH-0502, Safety Notice 95-02, "Independent Verification and Self-Checking," describes a technique that requires workers to (1) stop before performing the task to eliminate distractions and identify the correct component; (2) think about the task, expected response, and actions required if that response does not occur; (3) reconfirm the correct component and perform the function; and (4) review by comparing the actual versus the expected response. Although self-checking is typically associated with operator actions, these techniques can be applied by technicians and maintenance personnel to minimize human error. Human actions are a barrier that provides control over hazards associated with a job.

[1] OEAF engineers searched the ORPS database using the graphical user interface for reports from 01/01/94 to 11/12/97 with a Nature of Occurrence of "10 B Near Miss Occurrences," and found 538 occurrence reports with 539 events.

Safety Notice 95-02 can be obtained by contacting the ES&H Information Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874. The Safety Notice is also available on the Operating Experience Analysis and Feedback Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: short circuit, shock hazard, meter, switch, near miss

FUNCTIONAL AREAS: Electrical Maintenance, Modification

2. PORTABLE EYEWASH STATIONS FAIL TO MEET FLOW REQUIREMENTS

On October 22, 1997, at the Savannah River Site, a Central Services Works Engineering equipment repair mechanic reported to the Safety Activities Committee that the portable eyewash station assigned to him did not produce the required flow rate. The mechanic suspected the eyewash station was representative of similar units on the site, and he believed they all should be investigated. Engineers selected three portable eyewash stations at random for testing; all three failed to produce required flow limits. ANSI Z358.1, *American National Standard for Eyewash Stations and Showers*, requires portable eyewash stations to provide 0.4 gpm for a duration of 15 minutes. The eyewash stations tested provided approximately 1.6 gpm, but only for 3 to 4 minutes. Proper water flow and duration is important to ensure an adequate flush of the eyes in the event of an accident or chemical spill. (ORPS Report SR--WSRC-CSWE-1997-0012)

Engineers verified that the eyewash stations failed to meet the manufacturer's documented flow tests. Safety personnel advised Savannah River Site personnel to cease all work requiring the use of the portable eyewash stations. Safety engineers contacted Guardian Equipment, manufacturer of the portable eyewash stations (model G1512). A representative said that the model G1512 station was not intended to meet the ANSI requirement and stated that they offer another model that does. Engineers decided to field-modify these units by replacing the eyewash head. They tested the replacement head and determined it provides the required flow rate for the required duration.

Central Services Works Engineering personnel purchased the eyewash stations 2 years ago, believing they would meet ANSI flow requirements. Their purchase order clearly stated the flow requirements, and the manufacturer's brochure indicated the portable eyewash station would meet the ANSI requirement. The units did not require a receipt inspection, but they were flow-tested. However, the initial flow-test acceptance criteria were inadequate, so testers did not identify the problem.

Facility managers who have portable eyewash systems should verify that their systems meet recommended flow rate and duration requirements. OSHA 1910.1450, Appendix A, *National Research Council Recommendations Concerning Chemical Hygiene in Laboratories*, section D.4.(c), states that eyewash fountains should be inspected at intervals of not less than 3 months. Section E.1.(a) states: "in the event of a spill that contacts the eyes, promptly flush the eyes with water for a prolonged period (15 minutes) and seek medical attention."

KEYWORDS: eye wash, test, chemistry, industrial safety

FUNCTIONAL AREAS: Industrial Safety, Chemistry

3. CONFINED SPACE ENTRY VIOLATIONS

This week, OEAF engineers reviewed two recent confined space entry violation events. On November 4, 1997, at the Mound Plant, a power house stationary engineer entered a power house boiler without satisfying the requirements for confined space entry. The engineer exited the boiler when instructed to do so by industrial safety and health personnel. Facility management immediately stopped work on the boiler. On November 12, 1997, at the Weldon Spring Site, two subcontractor employees entered an open top tank in violation of confined space entry requirements. No safety or health consequences resulted from either of these events. Failure to follow confined space requirements could result in injury or death. (ORPS Reports OH-MB-EGGM-EGGMATO5-1997-0005 and ORO--MK-WSSRAP-1997-0016)

At the Mound Plant, utilities personnel were performing work on the power house boiler in preparation for a state inspection. The engineer entered the boiler before completion of the confined space permit, performance of atmospheric testing, or installation of a personal lockout/tagout and before a pre-job conference. Investigators determined that the engineer knew a confined space permit, atmospheric testing, and lockout/tagout were necessary. However, he did not understand that he was required to sign the permit and apply a personal lockout/tagout before entering the boiler. Immediately following the event, the facility manager stopped preparations for the state inspection. He reminded all power house personnel of the confined space entry permit procedure and the need to meet the pre-job briefing requirements for performing high-risk activities. He also reminded them to follow appropriate lockout/tagout procedures for authorized personnel. Planned corrective actions include conducting (1) authorized lockout/tagout training, (2) confined space requirements refresher training, and (3) a review of the work control system.

At the Weldon Spring Site, subcontractor workers were installing piping at the cement stabilization/solidification facility. Two workers entered a 33-foot-diameter, 30-foot-high, open-top tank through a manway without reading and signing the confined space permit, without harnesses and lifelines, and without an attendant present. The tank was clean and empty. Facility managers held an incident review meeting and discussed the importance of (1) reviewing and signing a confined space permit, (2) using harnesses or lifelines, and (3) requiring an attendant to be present while workers are in tanks. Facility managers are developing corrective actions.

NFS has reported violations of confined space entry requirements in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-40 reported two events. At Brookhaven National Laboratory, two technicians worked in a cryogenic valve box without a safety watch and without satisfying all training requirements. At Oak Ridge National Laboratory, an inspector entered a confined space before a confined space entry permit had been reviewed or approved. (ORPS Reports CH-BH-BNL-BNL-1997-0030 and ORO--ORNL-X10PLEQUIP-1997-0010)

- Weekly Summary 97-11 reported that a subcontract worker at the Savannah River Site violated a confined space work permit by working in a confined space without continuous air monitoring or signing the permit. (ORPS Report SR--WSRC-RMAT-1997-0003)

- Weekly Summary 96-38 reported that a Sandia National Laboratory subcontractor entered a confined space without calibrated, inspected monitoring equipment; without an attendant; and without a posted confined space permit. (ORPS Report ALO-KO-SNL-CASITE-1996-0009)

OEAF engineers searched the entire ORPS database for reports with any narrative containing “confined space” and “violation@” and found 71 reports. Facility managers reported personnel error as the direct cause in over 75 percent of these reports. Further review determined that procedure not used or used incorrectly accounted for 85 percent of the personnel errors. The following are some examples of "procedure not being used or used incorrectly," as reported in ORPS.

- The attendant stationed outside the confined space left without informing the worker inside the confined space.
- A craftsman was locked inside a confined space when co-workers failed to verify the space was clear before locking the door.
- Workers entered a confined space before performing atmospheric testing.

These events are significant because they illustrate that workers continue to violate confined space requirements despite programs specifically designed to protect them. In a critique of the Mound Plant event, attendees determined that this engineer did not have an adequate awareness or understanding of confined space and lockout/tagout requirements.

The National Institute for Occupational Safety and Health reports that about 63 occupational fatalities per year in the United States are caused by improper confined space entries. OSHA reports that over 60 percent of the fatalities were would-be rescuers and estimates that 85 percent of deaths and injuries in confined spaces could be prevented if industry would fully implement sound confined space entry permit programs. Following are examples of elements that should be included.

- identifying and evaluating permit space hazards before entry
- establishing and implementing means to prevent unauthorized entry
- establishing and implementing means to eliminate or control hazards necessary for safe entry
- providing, maintaining, and requiring the use of personal protective equipment necessary for safe entry
- requiring testing of atmospheric conditions inside the space before entry
- ensuring that at least one attendant is stationed outside during entry
- coordinating with any contractors used
- implementing rescue procedures
- establishing a written permit system
- reviewing the permit system annually

Facility managers and personnel responsible for implementing confined space entry programs should ensure that all aspects of OSHA standards are incorporated into procedures. They should also ensure that workers who enter confined spaces implement these procedures effectively. OSHA also requires training to ensure that employees involved in confined space work can perform their job functions safely. This training covers specific items for the authorized entrant, the attendant, and the entry supervisor. Training for confined spaces should be rigorous and should ensure that workers understand the requirements as well as the potential consequences of their actions. Training should emphasize that even in confined spaces that workers believe are free of hazardous materials there may be heavier-than-air gasses. These gasses, typically found at industrial facilities, may displace air in low-lying areas and present an asphyxiation hazard.

Facility managers should consult the following documents when reviewing their confined space

programs.

- OSHA Standard 29 CFR 1910.146*, Permit-Required Confined Spaces*, contains requirements for practices and procedures to protect employees from the hazards of confined space entry. This standard is available at URL http://www.osha-slc.gov/.

- DOE/EH-035P, *OSH Technical Reference Manual*, chapter 4, "Confined Space Entry," provides a checklist for employees and supervisors to follow. This document is available at URL http://tis.eh.doe.gov:80/docs/osh/otr.

KEYWORDS: confined space, lockout and tagout, work permit

FUNCTIONAL AREAS: Industrial Safety, Training and Qualification

4. OPERATIONAL SAFETY REQUIREMENT VIOLATIONS AT ROCKY FLATS

This week OEAF engineers reviewed two reports regarding operational safety requirement violations at the Rocky Flats Environmental Technology Site. On November 4, 1997, fire protection personnel and a shift operating engineer discovered a fire-suppression supply valve in the closed position. The building manager determined that this constituted an operational safety requirement violation because two operable fire suppression systems are required and the closed valve rendered one of the two inoperable. Investigators determined that maintenance personnel replaced part of the system several days earlier, and the work package did not provide instructions to verify the system alignment when the work was completed. On November 6, 1997, an operations manager reviewing completed surveillances determined that fire protection personnel performing a monthly surveillance did not notice the closed valve or see that several others were not locked opened as required by the surveillance procedure. The building manager determined that this was also an operational safety requirement violation because fire protection personnel failed to perform an adequate surveillance within the surveillance grace period. The facility manager terminated all affected facility operations. Failure to ensure proper system alignment and an inadequate surveillance resulted in two operational safety requirement violations and termination of affected facility operations. (ORPS Reports RFO--KHLL-371OPS-1997-0095 and RFO--KHLL-371OPS-1997-0097)

On November 1, maintenance personnel replaced two fire suppression system assemblies (consisting of two check valves with a gate valve on either end) in a ventilation system filter plenum. Fire protection personnel isolated the fire water and removed locks and chains on the existing assemblies before work began. The maintenance supervisor expected fire protection personnel to ensure the correct system alignment and re-install the locks and chains after maintenance personnel completed the replacement, but they did not. When fire protection personnel performed a monthly surveillance of the assemblies 2 days later, they did not notice that one of the valves was closed and that locks had not been installed on three others.

The facility manager held a fact-finding meeting. Attendees learned that there are no facility procedures for manipulating fire protection valves during maintenance activities. Investigators determined that maintenance personnel used a standard work package for "troubleshooting and repair," and it did not include specific instructions for replacing the assemblies. However, the work package directed fire protection personnel to ensure the fire suppression valves were locked in open positions after maintenance completed the replacement. Investigators determined that fire protection personnel did not review the package before beginning work and maintenance personnel did not have it at the job site during the assembly replacements. They also determined that the work package deferred system operability testing until performance of an annual fire protection test instead of requiring post-maintenance testing. Investigators determined that the

fire protection personnel who performed the monthly surveillance were not required to climb a ladder to inspect the valves (approximately 12-feet overhead). Fire protection personnel are developing procedures for valve manipulations, and the facility manager is developing corrective actions.

NFS has reported inadequate return-to-service of equipment and inadequate surveillance performance in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-12 reported that electricians at the Savannah River Site did not remove a blocking device on an under-voltage relay for a circuit breaker after maintenance. This prevented the circuit breaker from tripping during a load test of a diesel generator. Investigators determined that the electricians signed the procedure to indicate the device was removed and that a post-maintenance test or surveillance was not required to verify operability. (ORPS Report SR--WSRC-HCAN-1997-0012)

- Weekly Summary 96-50 reported that electricians at Argonne National Laboratory—West, discovered a mechanical transfer switch in the wrong position while attempting to conduct a quarterly diesel-generator load test. Investigators determined that workers had completed maintenance on the diesel generator and left the switch in the wrong position. They also determined the maintenance requirement card did not require repositioning the switch after the work was completed. (ORPS Report CH-AA-ANLW-AL-1996-0003)

- Weekly Summary 96-05 reported that electricians at a commercial nuclear facility failed to remove an electrical grounding device (a “grounding buggy”) before restoring power to a unit electrical bus. The grounding buggy caused a short circuit and a current surge to an auxiliary transformer. The transformer blew apart and ignited, resulting in the temporary loss of off-site power to the facility. A Nuclear Regulatory Commission inspection team determined that lack of effective procedures to assure adequate control of the installation and removal of grounding buggies was the root cause of the event. (USNRC Office of Public Affairs No. 96-16)

These events illustrate the importance of ensuring that equipment is properly returned to service. Temporary changes as a result of maintenance should always be properly documented, installed, removed, and independently verified to ensure the correct configuration is maintained. Temporary changes required for maintenance or testing require strict controls and attention to ensure safety functions are restored after maintenance is performed. This event also illustrates the importance of adequate pre-job planning and the use of job-specific work packages. In this event, development and use of a job-specific work package would have required pre-job planning that could have prevented this event. Detailed job-planning and work packages should be developed to ensure that system configurations are maintained within design and operational safety requirements.

Facility managers should review maintenance work control processes to ensure that proper return-to-service testing is included and that personnel clearly understand their responsibilities. They should also review procedures that require independent verifications and surveillance requirements to ensure they are adequate to identify system discrepancies if they exist. Facility managers should review the following guidance for additional post-maintenance testing and surveillance information.

- DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter VIII, “Control Of Equipment and System Status,” states that DOE facilities are required to establish administrative control programs to handle configuration changes resulting from maintenance, modifications, and testing. It also states that

control of equipment and system status should be established in accordance with formal guidance to ensure the proper configuration is maintained.

- DOE O 5480.22, *Technical Safety Requirements*, attachment 1, describes the purpose of surveillance requirements and states that each surveillance shall be performed within the specified interval. It also states that surveillance requirements must ensure that the quality of systems and components are maintained and the limiting conditions for operation will be met.

- DOE-STD-1050-93, *Guide To Good Practices for Planning, Scheduling, and Coordination of Maintenance at DOE Nuclear Facilities*, defines a post-maintenance test as any appropriate testing performed following maintenance to verify that (1) a particular piece of equipment or system performs its intended function based on its design criteria, (2) the original deficiency has been corrected, and (3) no new deficiencies are created.

- DOE-STD-1039-93, *Guide To Good Practices for Control of Equipment and System Status*, section 4.8, states that post-maintenance testing should verify that maintenance was performed correctly and that no problems were introduced as a result of the maintenance.

- NFS issued DOE/EH-0502, Safety Notice 95-02, "Independent Verification and Self-Checking," in September 1995 and DOE/EH-0513, Safety Notice 95-04, "Post-Maintenance Test Programs," in December 1995. These notices provide guidance and good practices for performing independent verification and guidance for establishing effective post-maintenance test programs. Safety Notice 95-02 and 95-04 can be obtained by contacting the Info Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72, Suite 100, Century XXI, Third Floor, Germantown, MD 20874. Safety Notices are also available on the OEAF Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

- DOE-HDBK-1062-96 "Fire Protection Handbook," August 1996, provides guidance for establishing comprehensive fire protection program requirements. The handbook states that (1) all fire protection system information should be documented in the appropriate level of detail, (2) fire protection documents should be reviewed by a person competent in the subject area, and (3) fire protection documents should be approved by the fire protection manager before use. The handbook requires generation of fire protection documents for system-related activities, including inspections, testing, maintenance, acceptance testing, calibration, and self-assessment.

KEYWORDS: fire protection, operational safety requirement, surveillance

FUNCTIONAL AREAS: Fire Protection, Surveillance, Configuration Control

5. INCOMPLETE FIRE ALARM SYSTEM SURVEILLANCE VIOLATES OPERATIONAL SAFETY REQUIREMENTS

On October 30, 1997, at the Los Alamos National Laboratory, the Chemistry and Metallurgy Research Facility manager determined that fire protection personnel did not perform the 1996 annual surveillance of battery backup power supplies for seven fire alarm panels. This constituted a violation of the facility operational safety requirements. On October 31, testing of the backup supplies revealed that the batteries had failed in the seven panels and the battery-charging

systems in three of the panels were inoperable. The failed backup supplies did not affect the facility fire suppression system, and all fire alarm panels remained operational while supplied by normal electrical power. Maintenance personnel replaced the failed batteries and returned four of the seven panels to full operation. Because the three failed charging systems could not be repaired, the facility manager initiated compensatory administrative actions (24-hour fire watches) to augment the function of these panels. This issue is significant because failure to conduct or complete surveillances of operational safety-required systems violates the safety requirements that represent the minimum acceptable controls necessary to ensure safe operation. (ORPS Report ALO-LA-LANL-CMR-1997-0021)

There are a total of 22 of these panels at the Laboratory, including those at the Chemistry and Metallurgy Research Facility. AutoCall manufactured the type NA-3 panels in the 1970s, and the panels have been in service at the Laboratory for over 20 years. However, AutoCall no longer manufactures the NA-3 panels, and spare parts are not available. Each panel has a secondary power supply system that can power the panel in the event of a loss of normal electrical service. The secondary supplies, which essentially consist of a re-chargeable battery and a charging system, are required by NFPA 72, *National Fire Alarm Code*. Section 1-5.2.6 of the code states: "the secondary supply shall have sufficient capacity to operate a protected premises, central station, or proprietary system for 24 hours . . . and at the end of that period, shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of an emergency for 5 minutes." The secondary supplies must also be fully operational to meet the facility operational safety requirements. Section 3.3.1.1 of the requirements states: "the sprinkler system when activated sends an alarm to the Central Alarm Station . . . . "

The facility manager convened a critique of this event. Critique members determined that, during the 1996 surveillance, fire protection personnel identified serious problems in nearly all of the secondary supplies they tested. They also determined that the problems could not be corrected because of the lack of replacement parts for the panels. Critique members learned that fire protection personnel told maintenance personnel to place impairment tags on all 22 panels, but they placed tags on only a few of the panels at the Laboratory and did not place any on the panels at the Chemistry and Metallurgy Research Facility. No documentation of the 1996 surveillance of the secondary supplies for the Laboratory's 22 panels could be found. Facility managers and fire protection personnel recalled informally discussing the problems with the secondary supplies, but they took no action to correct the problem. In addition, facility managers did not review the impact of the secondary supply problems on facility operational safety requirements. Therefore, they took no compensatory actions. Critique members learned that the main problem with the secondary supplies was that the charging systems in the panels were originally designed for NICAD batteries, but personnel modified them to accommodate installation of Gelcell type batteries. The modifications were a cost-saving measure; however, the manufacturer did not support the replacement. The existing NA-3 systems are slated to be replaced during the facility upgrades project, but the upgrades project has been suspended because of scope and funding issues.

The following are some corrective actions identified by critique members.

- Fire protection and operations personnel will review the possible long-term engineering solutions to correct the charging system problems with the Laboratory's NA-3 panels with the manufacturer.

- Fire protection personnel will notify the facility managers responsible for the 15 other NA-3 panels about the problems associated with the charging systems. Maintenance personnel will also perform surveillance testing on the other 15 panels and will repair them or implement appropriate compensatory measures.

- Operations personnel will add an annual surveillance of the fire alarm panel secondary supply systems in the Chemistry and Metallurgy Research Facility to their operational safety requirements surveillance list.

NFS has reported numerous events in the Weekly Summary on operational safety requirement violations. Following are examples that affected fire protection systems.

- Weekly Summary 97-15 reported that a monthly inspection of the fire protection system at the Oak Ridge National Laboratory was not performed as specified in the operational safety requirements. Managers, conducting an annual surveillance of inspection records to verify compliance, discovered that fire department personnel missed an inspection because of their informal policy for establishing inspection frequencies. (ORPS Report ORO--ORNL-X10REDC-1997-0002)

- Weekly Summary 96-41 reported that a fire protection inspector blocked a fire protection system master box while connecting power to a fire system in a building at the Oak Ridge Y-12 site. The master box transmits fire alarm signals to the fire department alarm room and the site operations center. However, it also served several fire systems required by the operational safety requirements. The blocking action went beyond the original job scope, was not approved, and disabled portions of the system required by operational safety requirements. (ORPS Report ORO--LMES-Y12NUCLEAR-1996-0021)

DOE facility managers should ensure that surveillances of operational safety-required systems are completed and that these systems are properly maintained. If the systems cannot pass their surveillances or be maintained operational, appropriate compensatory measures should be taken. DOE O 5480.22, *Technical Safety Requirements*, general principle 1, states: "A system is considered operable as long as there exists assurance that it is capable of performing its specified safety function(s)." Surveillance testing is essential in providing this assurance. DOE contractors who operate nuclear facilities and fail to conduct required surveillances or implement corrective actions for identified deficiencies could be subjected to Price-Anderson civil penalties under the work processes and quality improvement provisions of 10 CFR 830.120, “Quality Assurance Requirements.” DOE 0 420.1, *Facility Safety* (previously 5480.7A, *Fire Protection*), section 4.2.2 “Fire Protection Design Requirements,” requires DOE facilities to have a means to summon the fire department, such as a fire alarm or signaling system. It also requires a means to notify and evacuate building occupants using a fire detection or fire alarm system.

KEYWORDS: surveillance, test, compliance, fire protection, operational safety requirement

FUNCTIONAL AREAS: Licensing/Compliance, Fire Protection

6. CRITICALITY INFRACTIONS AT ROCKY FLATS

On November 5, at Rocky Flats Environmental Technology Site, a DOE facility representative observing residue-sampling operations noticed that two containers were not stored in designated fixed positions in a storage cabinet, violating criticality spacing requirements. A residue-sampling team had transferred the material from a drum into the containers the previous day. Investigators determined that a radiological control technician was not available to oversee transfer of the containers to another location, so they locked the containers in the cabinet. Investigators determined that the residue-sampling team also violated procedures when they opened the drum containing fissionable material without obtaining a criticality safety evaluation or determining criticality safety limits. Failure to meet spacing and handling requirements resulted in reduced criticality safety margins. (ORPS Report RFO--KHLL-371OPS-1997-0096)

The facility manager held a fact-finding meeting and determined that the containers were joined together and held material containing more than 200 grams of plutonium. Investigators determined that building limits did not allow the drum to be opened in the area, and postings indicated that the drum should not be opened. They also determined that the residue-sampling team opened the drum without reading the nuclear material safety limits shown on the drum label and that procedures did not exist for opening drums that contain more than 200 grams of plutonium. The facility manager suspended all residue-sampling operations until corrective actions can be developed and implemented.

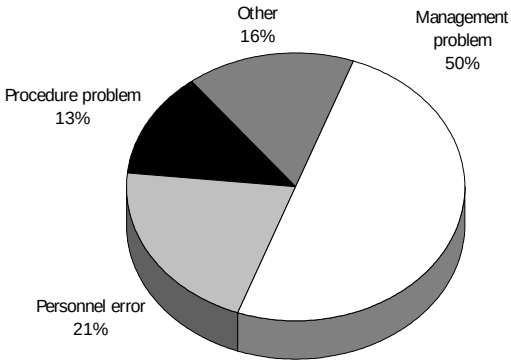
NFS has reported similar criticality safety issues in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-28 reported that waste management personnel at the Fernald Environmental Management Project violated two nuclear criticality safety controls. The first violation occurred when they moved five drums and two containers of enriched restricted material without documented approval for the operation. The second violation occurred because the supervisor assigned to the project was not trained as a fissionable material handlers supervisor. (ORPS Report OH-FN-FDF-FEMP-1997-0038)

- Weekly Summary 97-06 reported that fissile material handlers at the Fernald Environmental Management Project violated plant procedures when they moved a drum containing enriched restricted material from one facility to another without approval. Investigators determined that the drum was one of several containing enriched restricted material moved to a repackaging facility. (ORPS Report OH-FN-FDF-FEMP-1997-0013)

- Weekly Summary 97-02 reported that a solid waste operator at Hanford Plutonium Finishing Plant discovered an isolated transport container, holding an undetermined amount of hood waste, located approximately 2 feet from a fixed array wagon containing 167 grams of plutonium. The criticality-prevention specification general limit requires a 3-foot minimum spacing between an undetermined amount of plutonium and quantities of plutonium greater than 100 grams. While developing the recovery plan, a material handler discovered the fixed array wagon cylindrical positioning restraints were not closed and fastened as required by the criticality-prevention specification. (ORPS Report RL--PHMC-PFP-1996-0015)

OEAF engineers searched the ORPS database from 1990 to present for events involving nuclear material inventory storage violations and found 323 occurrences. Figure 6-1 shows the root causes for these events. A review of these occurrences shows that DOE facility managers reported 50 percent of the root causes as management problems, with 42 percent attributed to inadequate administrative control.



Management Problem	Percent
Inadequate administrative control	42
Other management problem	27
Policy not adequately defined, disseminated, or enforced	24
Work organization/planning deficiency	7

Figure 6-1. Root Causes for Nuclear Material Inventory Storage Violations[1]

This event illustrates the potential effects of weaknesses in conduct of operations. In this event (1) personnel failed to adhere to area postings; (2) procedures did not exist for the evolution; and (3) work was performed without review of material nuclear safety limits. The responsibility for ensuring adequate planning and control of work activities resides with line managers. Facility managers and supervisors should ensure plan-of-the-day meetings or pre-job briefings are performed, the responsibilities of personnel are clearly defined, and the expectations of the task are correctly understood. They should also monitor activities by performing frequent direct observations of specific activities and routine walk-downs.

Facility managers should ensure that all operators and supervisors are familiar with operating procedures and understand their purpose and use. This is even more important when criticality safety issues are involved.

- DOE O 420.1, *Nuclear Criticality Safety*, provides direction for establishing nuclear criticality safety program requirements.

- DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities,* chapter I, "Operations Organization and Administration," states: "A high level of performance in DOE operations is accomplished by establishment of high operating standards by management . . . by providing sufficient resources to the operations department, by ensuring personnel are well trained . . . and by holding workers and their supervisors accountable for their performance in conducting activities. Chapter II, "Shift Routines And Operating Practices," requires personnel to adhere to operating procedures and sound operating practices. Chapter XVII, "Operator Aid Postings," discusses adherence to posted information to aid personnel in performing their duties. The Order also states that it is the responsibility of the on-shift operating crew to safely operate the facility through adherence to operating procedures and technical specification or operational safety requirements and through the use of sound operating practices.

KEYWORDS: nuclear criticality safety, work control

FUNCTIONAL AREAS: Nuclear/Criticality Safety, Operations

[1] OEAF searched the ORPS database using the graphical users interface for reports with all narrative containing "(kilogram@ OR gram@ OR millicuri@ OR curie@) AND (fissile OR special OR snm@ OR limit@ OR inventor@) AND (order@ OR stand@ OR tsr OR osr OR proced@ OR admin@ OR require@ OR control@)" AND NOT "(alarm@ OR fuel@ OR contamin@ OR expos@ OR explosi@ OR dose@ OR calibrat@)" AND nature of occurrence codes "01" (facility condition) OR "5J" (material control and accountability) OR "7" (value basis reporting) OR "10" (cross-category items) and found 323 occurrences. Based on a random sampling of 25 events, OEAF engineers determined that each slice is accurate within ± 1.3 percent.